

## **CONNECTOR PIN ASSEMBLY AND ASSOCIATED APPARATUS**

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### **BACKGROUND OF THE INVENTION**

The present invention generally relates to material displacement apparatus such as excavating equipment and, in illustrated embodiments thereof, more particularly relates to apparatus for releasably coupling a  
10 replaceable excavating tooth point or other wear member to an associated adapter nose structure.

A variety of types of material displacement apparatus, such as excavating equipment, are provided with replaceable wear portions that  
15 are removably carried by larger base structures and come into abrasive, wearing contact with the material being displaced. For example, excavating tooth assemblies provided on digging equipment such as excavating buckets or the like typically comprise a relatively massive adapter portion which is suitably anchored to the forward bucket lip and  
20 has a reduced cross-section, forwardly projecting nose portion, and a replaceable tooth point having formed through a rear end thereof a pocket opening that releasably receives the adapter nose. To captively retain the point on the adapter nose, generally aligned transverse openings are formed through these telescoped elements adjacent the  
25 rear end of the point, and a suitable connector structure is driven into and forcibly retained within the aligned openings to releasably anchor the replaceable tooth point on its associated adapter nose portion.

The connector structure typically has to be forcibly driven into the aligned tooth point and adapter nose openings using, for example, a sledge hammer. Subsequently, the inserted connector structure has to be forcibly pounded out of the point and nose openings to permit the worn  
5 point to be removed from the adapter nose and replaced. This conventional need to pound in and later pound out the connector structure can easily give rise to a safety hazard for the installing and removing personnel.

Various alternatives to pound-in connector structures have been  
10 previously proposed for use in releasably retaining a replaceable wear member, such as a tooth point, on a support structure such as an adapter nose. While these alternative connector structures desirably eliminate the need to pound a connector structure into and out of an adapter nose they typically present various other types of problems, limitations and  
15 disadvantages including, but not limited to, complexity of construction and use, undesirably high cost, difficult installation and removal and unintentional operational dislodgment of the installed connector structure from its associated tooth point and support structure.

A need accordingly exists for an improved wear member/support  
20 member connector structure. It is to this need that the present invention is directed.

## SUMMARY OF THE INVENTION

In carrying out principles of the present invention, in accordance with representative embodiments thereof, first and second members, illustratively an excavating adapter and associated tooth point, are  
5 captively retained in a telescoped relationship by a specially designed connector pin assembly embodying principles of the present invention. The connector pin assembly basically includes a body, a lock member and a resilient detent structure.

The body is removably received in aligned connector openings in the  
10 telescoped first and second members and blocks separation thereof from one another, the body having a passage extending inwardly through an outer surface thereof, the passage having a noncircularly shaped side surface section. Preferably, this noncircularly shaped side surface section has a polygonal shape which is representatively square. In a  
15 representatively illustrated version thereof, the body has an elongated flat shape with an exterior surface that extends between opposite end portions of the body, outwardly circumscribes its passage, and is substantially parallel to the length of the body.

The lock member is received in the body passage and is  
20 circumscribed by its noncircular side section, the lock member being rotatable relative to the body between a locking position in which a portion of the lock member, representatively a transverse lobe on an outer end portion thereof, blocks removal of the body from the aligned connector openings, and an unlocking position in which the lock member  
25 permits removal of the body from the aligned connector openings. The resilient detent member is carried by the lock member for rotation therewith, and is operative to releasably retain the lock member in its locking position.

In a first representative embodiment of the connector pin assembly, the resilient detent member has a periphery circumscribing the lock member and complementarily and slidably engaging the noncircularly shaped side surface section of the body passage. The lock member is  
5 captively retained within the body passage by a snap ring member carried by the lock member and received in a corresponding groove in the surface of the body passage.

In a second representative embodiment of the connector pin assembly, the lock member has a slot extending therethrough and  
10 opening outwardly through opposite outer side portions thereof. The resilient detent member extends through the slot and has opposite end portions projecting outwardly beyond these outer side portions and slidably engaging the noncircularly shaped side surface section of the body passage. The lock member is captively retained within the body  
15 passage by an annular bushing circumscribing the lock member and press-fitted into the body passage. An O-ring seal on the lock member slidably and sealingly engages a circular interior side surface portion of the bushing.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a longitudinally foreshortened, partially cut away side elevational view of a replaceable excavating tooth point telescoped onto a nose portion of an adapter structure and releasably retained thereon by a specially designed connector pin assembly embodying principles of the  
25 present invention;

FIG. 2 is an enlarged scale exploded perspective view of the connector pin assembly;

FIG. 3 is a reduced scale, partially phantom view of the connector pin assembly;

FIG. 4 is a laterally directed cross-sectional view through the connector pin assembly;

5 FIG. 5 is a reduced scale side edge elevational view of the connector pin assembly;

FIG. 6 is a reduced scale end elevational view of the connector pin assembly;

10 FIG. 7 is an enlarged scale partial interior cross-sectional view through the connector pin assembly taken along line 7-7 of FIG. 5;

FIGS. 8 and 9, respectively, are end and side elevational views of a hollow, square cross-sectioned resilient detent member utilized in an alternate embodiment of the connector pin assembly;

15 FIG. 10 is a simplified, somewhat schematic cross-sectional view, partially phantom, through a lock member portion of the alternate connector pin assembly embodiment;

FIG. 11 is an end view of the lock member portion of the alternate connector pin assembly embodiment;

20 FIG. 12 is a cross-sectional view through the FIG. 11 lock member taken along line 12-12 of FIG. 10; and

FIGS. 13 and 14, respectively, are schematic cross-sectional views through the FIG. 11 lock member in retention/locking and insertion/unlocking orientations thereof.

## DETAILED DESCRIPTION

As illustrated in FIGS. 1-7, this invention provides a specially designed connector pin assembly 10 which is used to releasably interconnect two telescoped members such as the illustrated excavating tooth point 12 (or other wear member) which is telescoped onto the nose portion 14 of an associated adapter structure 16 (or other support structure). The connector assembly 10 is passed inwardly through aligned connector openings 18,20 respectively formed in the tooth point 12 and the adapter nose 14 and locked therein to block outward removal of the point 12 from the adapter nose 14. For a more detailed description of this general type of excavating equipment connector pin structure, see U.S. Patent 6,108,950 which is assigned to the assignee of the present application and is hereby incorporated herein by reference.

In addition to its applicability to material displacement and excavating equipment, the connector pin assembly 10 may also be advantageously utilized in joining a wide variety of other types of telescoped members. Accordingly, it is to be clearly understood that principles of the present invention are in no way limited to the fields of material displacement and excavation equipment although such inventive principles are particularly well suited to such fields.

Connector pin assembly 10 includes an elongated metal main body portion 22 having an opening or passage 24 longitudinally extending inwardly through one end thereof, and opposite, longitudinally outwardly projecting end portions 23 that, as shown in FIG. 1, block removal of the point 12 from the adapter nose 14. Representatively, but not by way of limitation, the entire exterior periphery of the main body portion 22 is parallel to its length (i.e., the main body portion 22 does not appreciably taper laterally inwardly along its length) in a manner similar to that of the

flat connector member 60 illustrated and described in copending U.S. application serial no. 10/287,406 assigned to the assignee of the present application and which is hereby incorporated herein by reference.

Opening or passage 24 has a circularly cross-sectioned longitudinally  
5 outer portion 24a (see FIG. 2), a square cross-sectioned longitudinally  
intermediate portion 24b (see FIGS. 3 and 7), and a smaller diameter  
longitudinally inner circularly cross-sectioned portion 24c (see FIG. 3)  
inwardly tangential to the square cross-sectioned opening portion 24b.  
Outer opening portion 24a is outwardly tangential to the opening portion  
10 24b (i.e., tangential to its corner portions).

Still referring to FIGS. 1-7, connector pin assembly 10 also includes a  
rotatable metal lock member 26, an elongated rectangular detent  
member 28 formed from a resilient plastic or nylon material, an annular  
metal bushing 30, and a resilient O-ring seal member 32. The lock member  
15 26 has an elongated cylindrical body 34 with a rectangularly cross-  
sectioned slot 36 transversely extending through a longitudinally  
intermediate portion thereof and sized to complementarily receive the  
detent member 28 with opposite end portions thereof projecting  
outwardly from opposite outer side surface portions of the body 34. At  
20 the outer end of the body 34 is a hexagonal driving head 38 from which a  
retaining lobe 40 outwardly projects.

The connector pin structure 10 is assembled by first placing the O-  
ring 32 in an associated annular groove on the body 34 between the lobe  
40 and the transverse slot 36, and then placing the metal bushing 30 on  
25 the body 34 over the O-ring 32 (see FIG. 4). The resilient detent member 28  
is then inserted into the slot 36 and the lock member body 34 is driven  
into the opening 24 in the main body portion 22 to press fit the bushing  
30 into the opening portion 24a and bring the assembled lock member 26

to its FIG. 4 position within the main body portion 22. After the body portion 34 is driven to this position, the resilient detent member 28 (which is representatively of a nylon material) enters the square portion 24b of the body opening 24 as shown in FIG. 7.

5        With the inserted lock member 26 in its solid line insertion/unlocking orientation shown in FIG. 6, the lobe 40 is disposed within the periphery of the main body portion 22, and opposite end portions of the detent member 28 are received in opposite corner portions C1,C2 of the square opening portion 24b (see FIG. 7). The completed connector pin assembly  
10    10 is then inserted into the aligned point and adapter openings 18,20 as shown in FIG. 1 and the lock member 26 is rotated 90 degrees from its FIG. 6 solid line insertion/unlocking position to a retention/locking position in which the lobe 40 reaches its dotted line orientation in FIG. 6. In this position the lobe 40 extends outwardly beyond the periphery of the main  
15    body portion 22 and, as shown in FIG. 1, underlies a ledge 41 within the tooth point 12, thereby releasably locking the inserted connector pin assembly 10 within the aligned point/adapter openings 18,20 by blocking its longitudinal removal or dislodgement therefrom.

      When the lock member 26 is rotated from its insertion/unlocking  
20    position to its retention/locking position, the opposite ends of the resilient detent member 28 are initially inwardly compressed against opposite side surfaces of the opening portion 24b (as indicated by the dotted line position of the detent member 28 in FIG. 7) and then snap outwardly into the opposite corner portions C3,C4 of the opening section  
25    24b as the lock member 26 reaches its retention/locking position.

      Since the resilient detent member 28 must be compressed during its rotational movement between the insertion and retention positions of the lock member 26, it resiliently resists undesired rotational movement



of the lock member 26 from its retention/locking position to its insertion/unlocking position to thereby prevent accidental dislodgement of the inserted connector pin assembly 10 from the tooth point/adapter openings 18,20. The press-fitted bushing 30 overlies and outwardly blocks the opposite ends of the detent member 28 to thereby captively retain the lock member 26 within the opening 24 of the main body portion 22. The O-ring seal 32 disposed within the press-fitted bushing 30 functions to inhibit dirt and other debris from entering the interior of the connector assembly 10 inwardly past such seal.

As can be seen, the interior opening or passage portion 24b within the main connector pin body portion 22 has a polygonal shape (representatively square) which circumscribes the inserted lock member 26. However, a variety of alternate polygonal and other non-circular shapes for this opening portion 24b could be utilized if desired.

An alternate embodiment 26a of the lock member 26 is shown in FIGS. 8-12 and is incorporated in an alternate embodiment 10a (see FIG. 10) of the previously described connector pin assembly 10. In turn, the illustrated connector pin assembly 10a is operatively installed in the previously described telescoped point 12 and adapter nose 14 in place of the previously described connector pin assembly 10 shown in FIG. 1. Lock member 26a has a cylindrical body portion 42 with a laterally inset square cross-sectioned central section 44. At the outer end of the body portion 42 is a hex head section 46 from which the retention lobe 40 outwardly projects.

The square central section 44 is received in a corresponding square central opening 48 of a square rubber detent member 50 captively retained on the body portion 42 between facing ledges on the cylindrical portions of the body portion 42 disposed on opposite ends of its central

square section 44. When the lock member 26a is driven into the opening 24 of the main body portion 22, the resilient detent member 50 enters the opening section 24b as shown in FIG. 13. Additionally, a snap ring 52 (see FIG. 10) carried on the inner end of the lock member body 42 is inwardly deformed and then snaps outwardly into a corresponding interior groove in the opening portion 24c to captively retain the inserted lock member 26a within the main connector pin body

With the inserted lock member 26a in its FIG. 13 retention/locking position, the corners C1',C2',C3',C4' of the detent member 50 are respectively received in the corners C1,C2,C3,C4 of the square opening section 24b so that the detent member 50 is complementarily received in the opening portion 24b and resiliently resists rotation of the lock member 26a to its insertion/unlocking orientation shown in FIG. 14. Such resistance is provided due to the fact that to effect such rotation, each opposite pair of corner sections of the detent member must be compressed toward one another during such rotation. During such compression thereof the detent member 50 continues to fill the opening portion 24b. Accordingly, the detent member 50 (in all of its rotational orientations) also serves as a sealing element to inhibit the entry of dirt and other debris into the interior of the connector pin assembly 10a. Because of this, the previously described O-ring 32 may be omitted. When the lock member 26a is rotated to its FIG. 14 insertion/unlocking orientation, the resilient detent member 50 is again complementarily received within the interior opening portion 24b, with the detent member corner portions C1',C4',C2',C3' being respectively received in the corner portions C4,C2,C3,C1 of the opening section 24b.

As can be seen from the foregoing, each of the representatively illustrated and described connector pin assemblies 10 and 10a may be inserted into the telescoped point 12 and adapter nose 14 (or other types of telescoped members as the case may be) without the necessity of  
5     pounding the assembly into place. Moreover, the assemblies 10 and 10a are each of a simple construction, are easy to install and remove, and provide, via their unique locking member detent structures, for improved retention of the installed connector pin assemblies in the members which they releasably retain in a telescoped orientation.

10     The foregoing detailed description is to be clearly understood as being given by way of illustration and example only, the spirit and scope of the present invention being limited solely by the appended claims.